

BACKGROUND PAPER**ON****SATELLITE SYSTEMS ANALYSIS (STOPLIGHT)****PURPOSE**

- The purpose of this background paper is to provide Lt General Kutyna information on the STOPLIGHT model and how it is being used by AFSPACECOM and USSPACECOM.

BACKGROUND

- After the failures of two Titan 34Ds and the STS, it became critically important for the operational space community to understand the impacts of the launch system standdown to the current and future on-orbit force structure. We found that while some systems have individual methods for looking at the current and future status, many did not and no two of the methods that did exist were compatible. This prevents decision makers from being able to review the status and projections for many systems without learning a new method for each.
- Based on this need, DO has developed a system for assessing and presenting the current and future status for all DoD satellite systems.

DISCUSSION

- The Satellite Systems Analysis model, known as STOPLIGHT due to its use of red, yellow and green color statuses, uses as inputs the current constellation requirements and status, and the current DoD Mission Model to assess current and future constellation status.
 - Each system has defined for it by PMD, congressional mandate, or some other means an approved constellation. For example, the DMSP PMD designates the required constellation as consisting of two operating satellites with no on-orbit spares.
 - The current constellation status includes state-of-health, launch date, and projected end-of-life for each satellite. The end-of-life projection is key to the entire model, since it dictates the necessary replacement dates. We use a variety of sources for this projection, always based upon the system owner/operator's best estimate. Some systems have relatively precise methods using analytical models based on observed degradation of specific components on-board the satellite. Others use 'gut feel', design mean mission duration, or historical averages.

Regardless of the system the owner/operator uses, we accept and use their estimate for projected end-of-life. In this way we ensure that we can represent the various systems from the operational perspective.

- The approved DoD Mission Model provides the best guess at the planned replacements for each satellite. We then calculate the number of satellites on-orbit at any point in time by adding current constellation satellites still alive to the satellites launched and checked-out.
- We compare the number of satellites projected to be on-orbit as described above to those required for a full constellation to determine a ratio. We performed a survey of various satellite systems to establish standard grading criteria. The criteria we defined are:
 - Green = 90 % or more of the required constellation is on orbit and mission capable.
 - Yellow = between 2/3 and 90% of the required constellation is on orbit and mission capable.
 - Red = 2/3 or less of the required constellation is on orbit and mission capable.
- For example, a satellite constellation requiring four satellites, and possessing three would be at 75% and would be considered Yellow.
- After developing this system a second (and probably more important) use was developed. In addition to projecting the status of a constellation into the future, STOPLIGHT can be used to assess a proposed mission model (launch schedule). By replacing the baseline DoD Mission Model with the proposed mission model, we can see how the proposal affects the operational missions. It is largely through this means that AFSPACECOM has injected itself into the mission model development process at Space Division as well as the mission model validation process at the Pentagon (Please see Background Paper: Mission Model Development and Validation)
- In addition to proposed mission model assessments, the impacts of any contingency, real or notional, can be assessed. When the FLTSAT-6 failure occurred, we were able to provide analytical assessments of the impacts to the AFSPACECOM and USSPACECOM staffs in a very short period (hours).

- The system's utility has been increased by the development of microcomputer software that provides graphic projections of satellite system status. This software was developed in-house and is maintained and operated by DO. At RADM Macke's request, a copy of this software has been provided to NAVSPACECOM.
- STOPLIGHT has received wide distribution and publication.
 - AFSPACECOM maintains five STOPLIGHT 'books', containing the analysis of all DoD and NASA satellite systems. These books are located at: the Space Operations Support Center (SOSC), the Space Systems and Activities Directorate (AFSPACECOM/DOS), USSPACECOM/J30, HQ USAF/XO, and NAVSPACECOM.
 - STOPLIGHT has been briefed to: Gen Piotrowski, VADM Ramsey and the USSPACECOM J-staff, Lt Gen Casey, Maj Gen Padden and the AFSPACECOM DCSS, Maj Gen Rankine (SAF/AQS), Maj Gen Burshnick (USAF/AXO), Brig Gen Moorman (SAF/SS), Brig Gen Lindsay (then SD/CL), RADM Macke (NAVSPACECOM/CC), and through many other organizations.
 - STOPLIGHT has been described in Aviation Week and Space Technology (30 Mar 87, pp 22-23) and The New York Times (20 July 87, pp 1,5,17)

BOTTOM LINE

- STOPLIGHT is a widely accepted system that can be used to graphically analyze real and notional situations to allow us to better plan deployment and operation of space systems.